

BAB VI

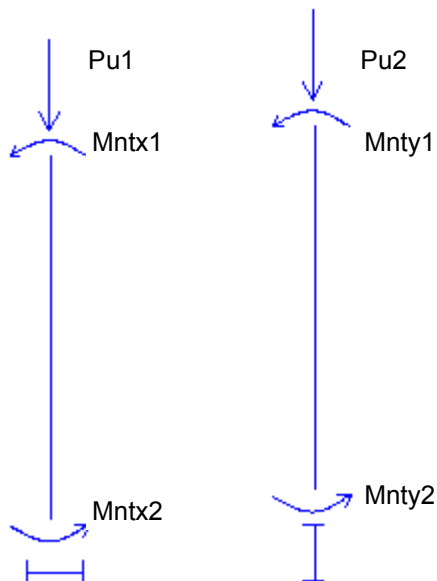
PERENCANAAN KOLOM K2

6.1 Kolom dipakai profil WF 350 x 175 x 7 x 11

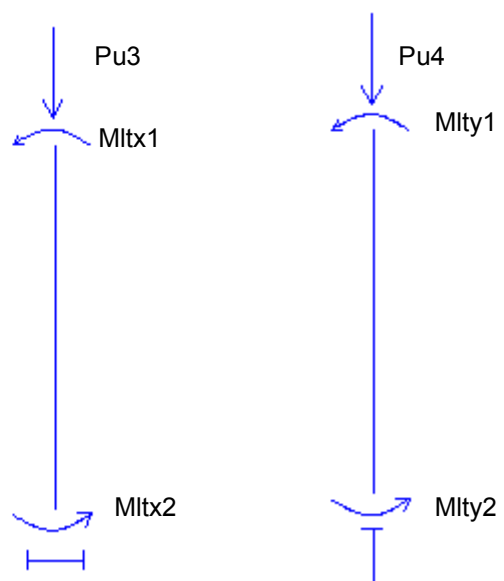
$W := 49.6$	kg/m'	$I_x := 13600$	cm ⁴
$A_g := 63.14$	cm ²	$I_y := 984$	cm ⁴
$d := 350$	mm	$i_x := 14.7$	cm
$b_f := 175$	mm	$i_y := 3.95$	cm
$t_w := 7$	mm	$S_x := 775$	cm ³
$t_f := 11$	mm	$S_y := 112$	cm ³
$r := 14$	mm	$Z_x := 841$	cm ³
$h := d - 2 \cdot (t_f + r) = 300$	mm	$Z_y := 172$	cm ³

BJ 37 : $f_y := 240$ Mpa $E := 2 \cdot 10^5$ Mpa
 $f_u := 370$ Mpa

KOLOM TAK BERGOYANG (D + L)



KOLOM BERGOYANG (GEMPA)



DARI HASIL ANALISA SAP 2000 DIDAPAT :

$Pu1 := 27278.6$ kg $Pu3 := 27278.6$ kg

$Pu2 := 85.69$ kg $Pu4 := 85.69$ kg

Tanpa goyangan : $Mntx1 := 4364.822$ kgm
 $Mntx2 := 3603.33$ kgm

Dengan goyangan : $Mltx1 := 4364.822$ kgm
 $Mltx2 := 3603.33$ kgm

$$\Sigma Nu := (14 \cdot Pu1) = 381900.4 \text{ kg}$$

- Untuk arah X

$$I_{xc} := I_x = 13600 \text{ cm}^4 \text{ (kolom)}$$

$$I_{xb} := 4050 \text{ cm}^4 \text{ (balok)}$$

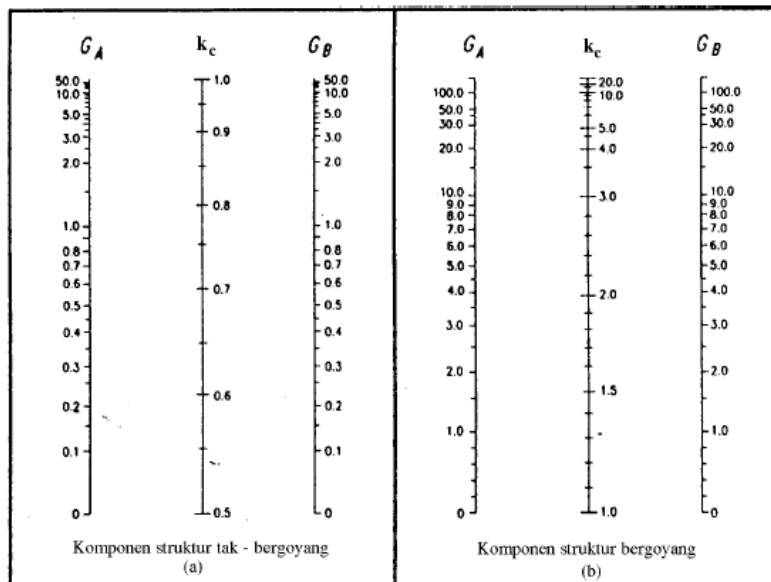
$$G_A := \frac{\left(\frac{I_{xc}}{215} \right)}{\left(\frac{I_{xb}}{215} \right)} = 3.358$$

$$G_B := 1$$

dari nomogram peraturan LRFD (SNI 03-1729-2002) didapatkan :

$$K_{cx1} := 0.84 \text{ tak bergoyang}$$

$$K_{cx2} := 1.62 \text{ bergoyang}$$



- Untuk arah Y

$$I_{yc} := I_y = 984 \text{ cm}^4 \text{ (kolom)}$$

$$I_{yb} := 984 \text{ cm}^4 \text{ (balok)}$$

$$G_A := \frac{\left(\frac{I_{yc}}{215} \right)}{\left(\frac{I_{yb}}{215} \right)} = 1$$

$$G_B := 1$$

dari nomogram peraturan LRFD didapatkan :

$$K_{cy1} := 0.78 \text{ tak bergoyang}$$

$$K_{cy2} := 1.32 \text{ bergoyang}$$

- Kontrol Penampang

$$\text{Badan} \quad \frac{h}{t_w} = 42.857 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 7.955 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

Penampang kompak $M_{nx} = M_{px}$

- Kontrol Kelangsingan Kolom

A. Kolom bergoyang

$$\lambda_x := \frac{215 \cdot K_{cx2}}{i_x} = 23.694$$

$$\lambda_y := \frac{215 \cdot K_{cy2}}{i_y} = 71.848 \quad \text{Menentukan !!}$$

Tekuk kritis arah y : $\lambda_y > \lambda_x$

$$\lambda_c := \left(\frac{\lambda_y}{\pi} \right) \cdot \sqrt{\frac{f_y}{E}} = 0.792 \quad \dots\dots\dots \lambda_c > 1.2$$

$$\omega := 0.25 \cdot \lambda_c^2 = 0.157$$

$$\Phi P_n := \frac{0.85 A_g \cdot f_y \cdot 10}{\omega} = 820885.614 \quad \text{kg}$$

$$P_u := P_{u1} = 27278.6 \quad \text{kg}$$

$$\frac{P_u}{\Phi P_n} = 0.033 \quad \blacksquare < \blacksquare \quad 0.2 \quad \text{Rumus interaksi 2}$$

$$N_{crx} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 1985739281.222 \quad \text{kg}$$

$$N_{cry} := \frac{A_g \cdot E \cdot 10 \cdot \pi^2}{\lambda_c^2} = 1985739281.222 \quad \text{kg}$$

$$\Sigma N_{crsx} := 2 \cdot N_{crx} = 3971478562.443 \quad \text{kg}$$

$$\Sigma N_{crsy} := 7 \cdot N_{cry} = 13900174968.551 \quad \text{kg}$$

B. Kolom tak bergoyang

$$\lambda_{x1} := \frac{215 \cdot K_{cx1}}{i_x} = 12.286$$

$$\lambda_{y1} := \frac{215 \cdot K_{cy1}}{i_y} = 42.456$$

$$N_{crbx} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{x1}^2} = 101445761.702 \quad \text{kg}$$

$$N_{crby} := \frac{\pi^2 \cdot A_g \cdot E \cdot 10}{\lambda_{y1}^2} = 29356099.54 \text{ kg}$$

- Momen Ultimate

- Terhadap sumbu X

$$C_{m1} := 0.6 - 0.4 \cdot \left(\frac{M_{ntx2}}{M_{ntx1}} \right) = 0.27$$

$$\delta_{bx} := \frac{C_{m1}}{1 - \left(\frac{P_{u1}}{N_{crbx}} \right)} = 0.27 \quad \blacksquare < \blacksquare 1$$

$$\delta_{bx} := 0.307$$

$$\delta_{sx} := \frac{1}{1 - \left(\frac{6 \cdot P_{u1}}{\sum N_{crsx}} \right)} = 1$$

$$M_{ux} := \delta_{bx} \cdot M_{ntx1} + \delta_{sx} \cdot M_{ltx1} = 5705.002 \text{ kgm}$$

- Kontrol Momen Nominal

Kontrol local buckling

$$\text{Badan} \quad \frac{h}{t_w} = 42.857 \quad \blacksquare \leq \blacksquare \quad \frac{1680}{\sqrt{f_y}} = 108.444$$

$$\text{Sayap} \quad \frac{b_f}{2 \cdot t_f} = 7.955 \quad \blacksquare \leq \blacksquare \quad \frac{170}{\sqrt{f_y}} = 10.973$$

$$\lambda_r := \frac{370}{\sqrt{240 - 70}} = 28.378 > \lambda = 9.375 \quad \text{Penampang kompak!!}$$

Terhadap sumbu x

$$M_{nx} := Z_x \cdot f_y \cdot 10 = 2018400 \text{ kgcm}$$

$$M_y := S_x \cdot f_y \cdot 10 = 1860000 \text{ kgcm}$$

$$M_{nx} = 2018400 \text{ kgcm} \quad \blacksquare \leq \blacksquare \quad 1.5 \cdot M_y = 2790000 \text{ kgcm}$$

Terhadap sumbu y

$$M_{ny} := Z_y \cdot f_y \cdot 10 = 412800 \text{ kgcm}$$

- Kontrol lateral buckling

$$L_b := 50 \text{ cm}$$

$$L_p := 1.76 \cdot i_y \cdot \sqrt{\frac{2 \cdot 10^5}{f_y}} = 200.687 \text{ cm}$$

$$h_w := h - 2 \cdot (r + t_f) = 250 \text{ mm}$$

$$J := \frac{(h_w - 2 \cdot t_f)}{3 \cdot 10^4} \cdot t_f^3 + \frac{2}{3 \cdot 10^4} \cdot b_f \cdot t_f^3 = 25.644 \text{ cm}^4$$

$$I_w := \frac{I_y \cdot (h - t_f)^2}{4 \cdot 100} = 205461.66 \text{ cm}^6$$

$$x_1 := \frac{\pi \cdot \sqrt{\frac{(2 \cdot 10^6 \cdot 0.8 \cdot 10^6 \cdot J \cdot A_g)}{2}}}{Z_x} = 134444.636 \text{ kg/cm}^2$$

$$x_2 := 4 \cdot \left(\frac{Z_x}{0.8 \cdot 10^6} \right)^2 \cdot \frac{I_w}{I_y} = 0.000923 \left(\frac{\text{cm}^2}{\text{kg}} \right)^2$$

$$L_R := i_y \cdot \left(\frac{x_1}{2400 - 700} \right) \cdot \sqrt{1 + \sqrt{1 + x_2 \cdot (2400 - 700)^2}} = 2266.847 \text{ cm}$$

$L_p < L_b < L_r$ bentang menengah

- Kontrol Interaksi beam column

$$\left(\frac{P_u}{\Phi P_n} \right) + \left[\left(\frac{M_{ux} \cdot 100}{0.9 \cdot M_{nx}} \right) \right] = 0.347 \leq 1$$

Jadi H 350 x 175 x 7 x 11 dapat digunakan sebagai profil kolom